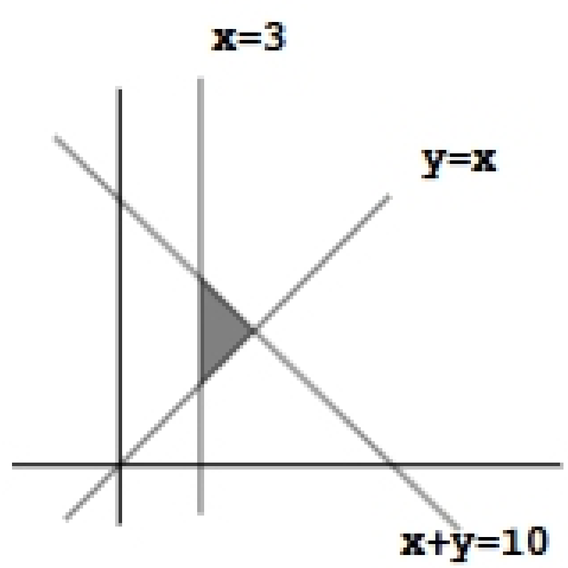
1. (a) False. This would be true for e^{x+y}.
   (b) True.
   (c) True
   (d) True. When using the values of θ, the only requirement is that the starting value and ending value can not have a difference of more than 2π.
   (e) False. To be true the inside integral needs to start at $z = 0$ not $z = 1$.
2. (a) $x^2 + y^2 = 4y$ this is a circle.
   (b) $\rho = 2\sec(\phi)$
   $\rho\cos\phi = 2$
   $z = 2$ this is a plane
3. Note: Since $f(x, y)$ is not a constant function, the volume of each of the 5 solids formed with the base being the leaf and the height being $f(x, y)$ will not be equal.

   Note 2: you can not integrate from 0 to 2π since on parts of this interval the radius will be negative.

   I have set up the integral for the leaf that is centered on the positive x-axis.

   $$\int_{-\pi/10}^{\pi/10}\int_0^{\cos(5\theta)} 3r^3\sin^2\theta \; dr d\theta$$
4. Change the limits of the integral to get: $\displaystyle\int_0^2\int_0^{2y} e^{y^2}\, dxdy$.

   integrating this gives $e^4 - 1$
5. The correct region has been shaded in the graph.



$$\int_3^5\int_x^{10-x} \sqrt{4^2+2^2+1}\, dydx = ... = 4\sqrt{21}$$

6. The surface is given by $z = \sqrt{9-y^2}$ so we get $z_x = 0$ and $z_y = \dfrac{-y}{\sqrt{9-y^2}}$

$$\int_0^2\int_0^{\sqrt{4-x^2}} \sqrt{\frac{y^2}{9-y^2}+1}\; dydx = \int_0^2\int_0^{\sqrt{4-x^2}} \sqrt{\frac{9}{9-y^2}}\; dydx$$

or $\displaystyle\int_0^{\pi/2}\int_0^2 r\sqrt{\frac{9}{9-r^2\sin^2\theta}}\; drd\theta$

7. Step 1 find the intersection of the sphere and the paraboloid.

   The paraboloid gives $z+4 = x^2+y^2$ substituting this into the sphere equation gives $z+4+z^2 = 6$. Solving gives $z = 1$ and $z = -2$. Since this is the top of the sphere $z = 1$ is what we want.

   The intersection is $x^2 + y^2 + (1)^2 = 6$ or $x^2 + y^2 = 5$

   Also note that $y \geq 0$ means that $0 \leq \theta \leq \pi$.

   $$\int_0^{\pi} \int_0^{\sqrt{5}} \int_{r^2-4}^{\sqrt{6-r^2}} r \; dzdrd\theta$$

8. $$\int_0^3 \int_0^{12-4y} \int_y^{(12-2y-z)/2} f(x,y,z) \; dxdzdy$$

9. (a) $$\int_{-\pi/2}^{\pi/2} \int_0^5 \int_r^{\sqrt{50-r^2}} zr^2 \sin\theta \quad dzdrd\theta$$

   (b) $$\int_{-\pi/2}^{\pi/2} \int_0^{\pi/4} \int_0^{\sqrt{50}} \rho^4 \sin^2\phi \cos\phi \sin\theta \quad d\rho d\phi d\theta$$

10. $$\int_0^{2\pi} \int_3^6 \int_1^{r\sin\theta+40} r^2 \cos\theta \quad dzdrd\theta$$

11. $$\int_{-2}^{2} \int_{y^2}^{8-y^2} k((x-14)^2 + y^2) \; dxdy$$